

# MANUFACTURING METHOD OF AN EYELESS SUTURE NEEDLE

## TECHNICAL FIELD

The present invention relates to a manufacturing method of an eyeless suture needle.

In a surgical operation and the like, an eyeless suture needle in which a suture thread is caulked and fixed to a blind hole of a thread attaching portion is used. Conventionally, first a needle tip portion and a needle body portion are processed to a round rod material, and then an opposite side of the needle tip portion is cut to a predetermined length. Thereafter, the blind hole of the thread attaching portion is formed by opening a hole to the cut surface to be parallel to a needle axis by a drill, laser, or electric discharge machining or the like (refer to Patent Literatures 1 to 3). Moreover, in a case of manufacturing a relatively long eyeless suture needle, there were cases where the needle tip portion and the needle body portion was processed by cutting to a predetermined length after providing the blind hole.

There has been also proposed to process the needle tip portion and the needle body portion to the round rod material and thereafter provide the blind hole by laser welding a pipe to a needle base, and further thereafter to conduct a bending process of the needle body portion (refer to Patent Literatures 4 to 6). However, it is very difficult to laser weld the pipe to a very thin needle body portion, and therefore it has not been practically used.

A general depth of the blind hole is approximately 2.5 times the blind hole diameter in view of the processing difficulty. For example, in a case of an eyeless suture needle of needle total length 15 mm, needle diameter 0.5 mm, blind hole diameter 0.25 mm, the depth of the blind hole is approximately 0.7 mm. The suture thread is caulked in a state where the suture thread is inserted to such shallow blind hole, and fixed to the blind hole.

In the Pharmaceutical Affairs Law, it is set forth that the drawing strength when separating the suture needle and the suture thread needs to be equal to or more than half of the suture thread strength. However, it is difficult to obtain such drawing strength.

If the caulking pressure is weakened, the thread will be cast-off by a small drawing force. On the other hand, if the caulking pressure is strengthened, problems occur such as the breakage of the suture needle or the like. Even by carefully adjusting the caulking pressure, it is very difficult to completely dissolve the defect of the drawing strength. Furthermore, a needle separated from the suture thread by a drawing strength test cannot be reused, and this becomes a cause of high cost.

In order to improve this problem, various conceptions have been proposed to increase the fixing strength of the suture thread by providing concavity and convexity or the like to an inner surface of the blind hole. For example, Patent Literature 1 discloses to form a twill line knurl in the inner surface of the blind hole. In Patent Literature 2, it is disclosed to open a prepared hole by laser processing or the like, and to provide additional processing by a drill or a tungsten round rod to expand the diameter of the hole, and also to leave a part of the prepared hole remained and form concavity and convexity. Moreover, Patent Literature 3 discloses to chamfer and to provide concavity and convexity to the inner surface of the hole by shot blasting.

## CITATION LIST

### Patent Literature

- 5 Patent Literature 1: Japanese Utility Model Application Laid-Open No. H02-51516
- Patent Literature 2: Japanese Patent Application Laid-Open No. H02-11239
- Patent Literature 3: Japanese Patent Application No. 2003-24334
- 10 Patent Literature 4: Japanese Patent Application Laid-Open No. S63-317148
- Patent Literature 5: Japanese Patent Application Laid-Open No. H01-162590
- 15 Patent Literature 6: Japanese Patent Application Laid-Open No. 2005-52654

## SUMMARY OF INVENTION

### Technical Problem

However, as recited in Patent Literature 1, when the twill line knurl is formed by cutting, a sharp convex portion is formed. Therefore, especially in a case of attaching a braided suture thread to the blind hole, the outer thread around the core thread is damaged at the convex portion and becomes the cause of breakage. Moreover, in a case where the hole diameter of the blind hole is equal to or less than 0.3 mm, processing is very difficult.

Moreover, as recited in Patent Literature 2, in a case of providing the blind hole by expanding the diameter of the prepared hole opened by laser processing, the concavity and convexity of the inner surface of the blind hole are not uniform. Moreover, since only large concavity and convexity are generated on the inner surface of the prepared hole formed by laser processing or the like, the fixation effect is poor.

It is disclosed in Patent Literature 2 that if additional processing is provided using a drill with respect to the prepared hole formed by laser processing, a spiral-like concavity and convexity is formed, and the fixation effect is increased. However, in a case of difficult-to-cut materials such as stainless steel material, by a slight abrasion of an outer periphery cutting blade portion of the drill tip end, a reamer like effect is generated and cuts to form a mirror surface. Therefore, the fixation effect is not so high. These also apply to a case the blind hole is formed only by a drill, and becomes the cause of insufficient drawing strength of the suture thread.

Moreover, as is recited in Patent Literature 3, even by shot blasting, the concavity and convexity of the inner surface of the blind hole is limited to the entrance portion of the hole. Therefore, the fixation effect is poor. Moreover, it is not preferable since the outer diameter portion is chamfered larger than the entrance portion of the hole.

In view of the above, it is an object of the present invention to provide a manufacturing method of an eyeless suture needle capable of making the drawing strength of the suture thread large and uniform.

### Solution to Problem

A manufacturing method of an eyeless suture needle of the present invention comprises a step of obtaining a pipe-like material by rolling a metal plate material, and welding abutting portions, a step of manufacturing a pipe-like member including a core drawing step of reducing a diameter and adjusting a thickness of the pipe-like material using a cored bar and a tube drawing step of reducing the diameter and